# MKPCL

*Bitmap to PCL File Converter for Unix & DOS*

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- Works on any character based terminal
- Simple command line user interface
- Creates HP compatible print file
- Supports .BMP, .PCX, and .JPG image file formats
- Image scaling, compression, and rotation
- Output image relocatable on page
- Easy integration into forms and reports

DOS - Copy MKPCL.EXE from the distribution to an appropriate directory in your path and the other sample files to any convenient directory for testing. The program is not dependent on any other config files for proper operation. It is, however, necessary to create a directory where mkpcl will write its temp files. By default, the program expects the directory \TMP to exist. Make it a shared folder if you put it on a network drive. Create \TMP, or if you prefer another location for the temp files see the PCLTEMP discussion below.

UNIX - Untar the files from distribution to any convenient directory, and then move to that directory. Copy the "mkpcl" executable to a directory in your PATH as appropriate to your needs. Set the ownership and permissions to suit. Copy the sample files to the directory of your choosing for testing.

PCLTEMP - The program respects the environment variable PCLTEMP, and you can set it to contain the path to the temp directory of your choosing. For example, if you prefer the temp files to be written to \u\tmp\temp then enter the command...

```
from DOS     set PCLTEMP=\u\tmp\temp\
from UNIX    PCLTEMP=/u/tmp/temp/; export PCLTEMP
```

Note that there is a trailing "\" or "/" depending on the OS. This IS required, and further you must create all of the components in the directory path if they don't exist already. Put the set PCLTEMP string in "autoexec.bat" or another suitable .bat file on DOS systems. On UNIX systems, "/etc/profile" or your ".profile" files are the likely locations.

Quick Start - The file 'logo.bmp' is a scan of our Spectra logo and can be used to demonstrate 'mkpcl' operation. First, enter ...

```
mkpcl logo.bmp logo.pcl
```

Now print the 'logo.pcl' file using the appropriate 'lp' command to direct the file to your LaserJet. The top left corner of the image is at location 0,0 (X,Y) in the PCL coordinate system.

Now try ... `mkpcl -x 2000 logo.bmp logo.pcl`

Print 'logo.pcl' again and you will see that the image is now over towards the right side of the sheet but still at the top.

This time ... `mkpcl -x 1025 -y 1350 logo.bmp logo.pcl`

When the file is printed this time the logo will be roughly centered on the page. As the coordinate system is 300 units per inch, you can place the image very accurately on the page by supplying the necessary X,Y values to 'mkpcl'.

The caldera.bmp file is a full color image, and the output from it can be manipulated as per the instructions on p. 9-10 of the manual. Print each of these as you create the .pcl file

```
mkpcl caldera.bmp caldera.pcl
mkpcl -B -30 caldera.bmp caldera.pcl
mkpcl -B -30 -H 220 caldera.bmp caldera.pcl
mkpcl -g 100 caldera.bmp caldera.pcl
```

Note: Unix users may need to add "-o raw" to the 'lp' command line to successfully print bitmap images.

**Overview**

**Mkpcl** is a UNIX/DOS program that converts a BMP, PCX, or JPG raster graphic file directly to a file that can be printed on an HP compatible laser printer. The program automatically determines the type of input file and proceeds accordingly. This software should be of interest to database or other users who find that their application provides no support for raster graphics and require a method to insert logos or other graphic images in their forms and reports.

New with Version 2, the input BMP/PCX/JPG file can contain a color, black & white, or grayscale image. Images with a pixel depth of 1, 4, 8, or 24 bits per pixel are all supported. Color images, when processed by **mkpcl**, are first converted to grayscale to await further processing. If you are scanning a new color image, it may be in your interest to output a grayscale file directly from the scanner. This will make the input file about one-third the size of its color counterpart.

**Figure 1**

The program is very easy to use. In general usage, you would type at the UNIX prompt:

**mkpcl [ -options ] inputfile outputfile**

where "inputfile" is the source BMP/PCX/JPG file and "outputfile" is the resulting printable PCL file to be used with your application. There is no restriction on the file naming placed by **mkpcl**; however, any rules imposed by the operating system will have to be followed.

**Mkpcl** provides a number of command line option flags that will modify the behavior of the program to change the printed image to suit your purpose. Note that none of these options in any way will change the BMP/PCX/JPG input file, so you can experiment quite freely without fear of damaging the original file. While there are several options available, most of the time it is quite likely that you won't need any of them and once in a while maybe just one or two. As a baseline reference, the image in Figure 1 required no options when the file was created, just the command **mkpcl inputfile outputfile**.

A bitmap or raster graphic image is composed of successive rows of dots that, in the case of a laser printer, are either black or white. The state of a dot is stored in one bit, where if the bit is "on" it prints black on the page. Thus one byte can store only 8 different dots from the image. The number of data bytes required to store a given image, then, is "(row width/8)*number of rows". Assuming a 300 dot per inch resolution, even a small image will require several thousand bytes to describe it. This leads us to the first of the options, compression.

**File Compression ( -c # )**

The raster data for the image in Figure 1 is 70,751 bytes and the with the added PCL overhead needed to print the file on a LaserJet, we get an actual print file of 74,339 bytes. As the HP printers have evolved over the last few years, different compression schemes have become available to reduce the amount of data that needs to be sent to the printer for a given image. But, because not all printers support all compression methods, we can't simply have a flag to turn compression on or off. How we choose to compress the image data will be dependent on the printer to be used to print it. There are four different levels of compression.

| Level | Type | Supported by | File Size |
|---|---|---|---|
| 0 | None | LJII and earlier | 74,339 bytes |
| 2 | TIFF | LJIIP | 34,674 |
| 3 | TIFF/Delta Row | LJIII | 22,444 |
| 4 | TIFF/Delta Row | LJIIIP, 4, and later | 21,009 |

The table above shows the file length actually achieved for the image in Figure 1 using the four different types of compression. You can see from the byte count that compressing the graphic is usually worthwhile. The compressed file doesn't actually save any printer memory in imaging the graphic because the file is uncompressed within the printer, but the time saved to transmit the file to the printer is significant. In this example, levels 3 and 4 both have a better than 3 to 1 compression ratio. Some images will compress more than 10 to 1! The bigger the file, the greater the potential resource saving. Line drawings will tend to compress more effectively than halftone photographic images.

To create a compressed print file, simply supply the desired compression level as an argument to the **-c** flag on the command line. For example,

**mkpcl -c 3 inputfile outputfile**

instructs the program to create the output using level 3 compression. While level 2 only uses TIFF to encode the image data, levels 3 and 4 use both TIFF and delta row compression. The HP compression routines are applied "intelligently"; i.e., each raster row is examined beforehand and

the most efficient compression method is used for that particular row. Therefore, it is very unlikely that using a lower compression level than your printer is capable of handling would ever be to your advantage, other than to make the file printable on as many printers as possible. In that case, the lowest common denominator would be level 0.

The program will default to level 0 if the **-c** flag is omitted from the command line, however, if you want to set up a different default(2, 3, or 4), set the environment variable PCLCOMP to the appropriate value. For example, from the prompt...

| | |
|---|---|
| UNIX users type | **PCLCOMP=4; export PCLCOMP** |
| DOS users type | **set PCLCOMP=4** |

From that point on your new default compression level would be 4. If you are only producing print files for one printer, you might set PCLCOMP in your .profile file. If PCLCOMP has been set, it can still be overridden by a **-c** flag entry on the command line.

**Image Scaling ( -s ### )**

The **-s** flag takes as an argument the percentage size of the original bitmap that is desired for the printed image, where 100% is the same size, values less than 100 indicate a reduction, and values greater than 100 indicate an enlargement. The program will permit percentages from as small as 10% with the upper limit being an image with a width or depth of about 8400 dots. The latter cover a legal size sheet at 600 dpi. That is undoubtedly a bigger image than your printer's memory can handle, and it is very unlikely that the limits at either end will even come close to being tested. Any positive value is valid otherwise.

The method used for scaling the image size is to duplicate or delete existing pixels from the original image, so you are NOT gaining any detail when you enlarge the image. We are effectively gaining image size at the expense of image resolution. That said, the image quality is pretty good overall and very good at relatively small magnifications of up to 150% or so. The image to the right is the same as Figure 1 but is reduced to 50% in size. The command line was **mkpcl -s 50 inputfile outputfile**. Compare this to the full size image and you will see that the drawing has held together quite well considering that 3/4 of the pixels in the original file have been deleted.

By contrast, the image in Figure 2 is the same drawing except that the scaling has now enlarged the drawing to 175% of the original size. Again, compare the enlargement to the original and you will see that it stands up pretty well. Its command line was **mkpcl -s 175 inputfile outputfile.** Enlarged images compress very well. Although the 175% magnification more than tripled the amount of image data, the print file only grew by about one third.

**Figure 2**

If you have the resources, you can always rescan the drawing or resize the original if it was a vector image of some kind. That obviously may not always be possible, but more to the point, scaling the image when creating the print file is very fast and you can change your mind and resize it again with little effort. This is especially useful if you are trying to fit an image into a very tight space. Very quickly three or four slightly different sized print files can be created and tested for the best fit. Corporate logos would be typical of the kind of thing that may need to be printed regularly at a variety of sizes.

The size of a bitmap can grow rapidly when enlarging an image. At 200% the bitmap has grown to four times its original size and there is always concern about the execution speed of the print file once in the printer. This is particularly important to database applications that may be printing the same image repeatedly in a single print run. A 200% image has both the number of rows and columns doubled so that each pixel in the old drawing is now represented by four pixels(2x2 grid) in the new one. There is another way to enlarge or reduce the image, by simply having the printer use larger or smaller pixels to form the image.

**Resolution ( -r ### )**

All of the LaserJet printers are capable of printing raster graphics at 75, 100, 150, or 300 dots per inch. In addition, the LaserJet 4 and later 600 dpi printers are also capable of 200 as well as 600 dpi. The physical size of the printed image is totally dependent on the resolution used to print it.

The image in Figure 1 was printed at 300 dpi. If it were printed at 150 dpi, the resulting image would be twice the size, an effective enlargement of 200%, but without any increase in the size of the output file. The identical image could be had at 300 dpi using a **-s 200** flag on the command

line, except the print file would be four times the size. If it works out that a change in the printing resolution will create the exact size that is needed, then a resolution change would generally be preferable to using a scale command. You would either get a smaller file in the case of an enlargement or finer detail in a reduction. On the other hand, printer resolution isn't a terribly practical means of image scaling because the choices are so limited, which means that most of the time none of the available resolutions would produce the wanted image size.

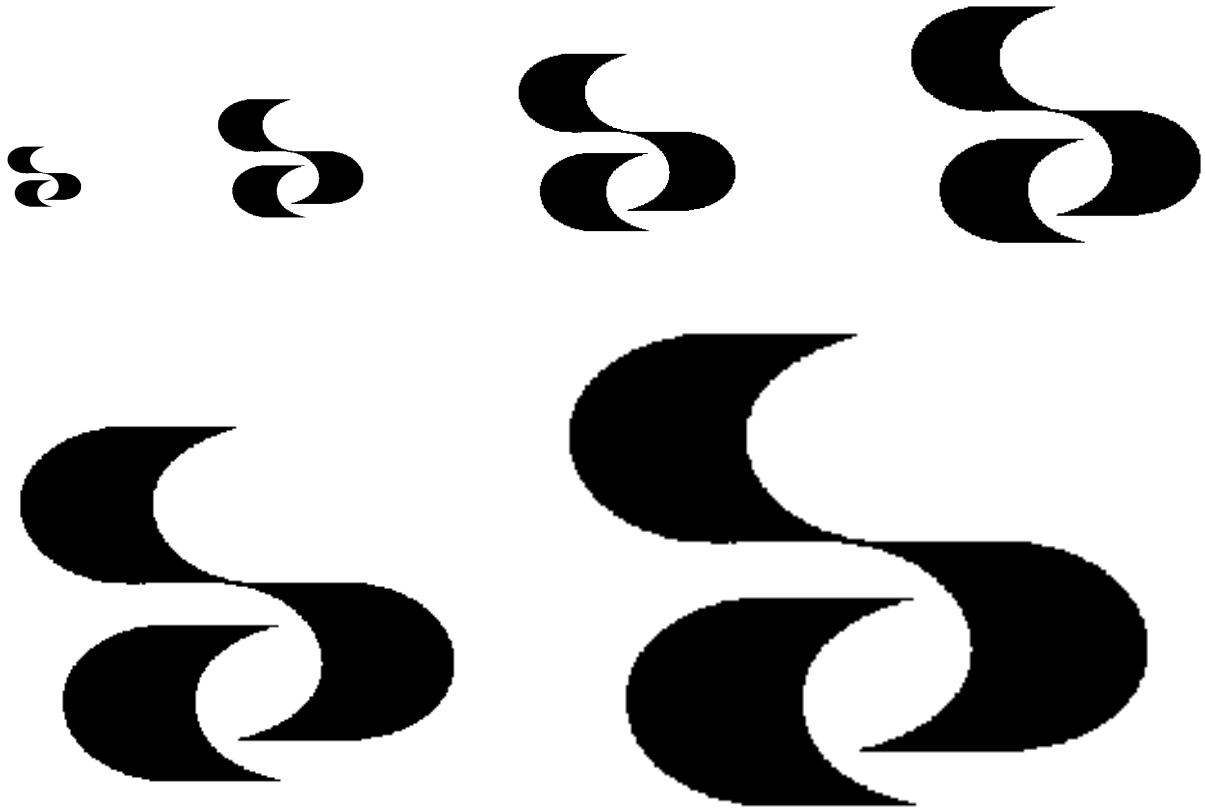


**Figure 3** – Resolution Variations

The effect of a change in printer resolution is demonstrated in Figure 3 where the identical bitmap image is printed at 600, 300, 200, 150 dpi on the top row and at 100 and 75 dpi on the bottom row. This particular logo with its curved lines is a good example to show what can happen to a drawing when printed at a coarser resolution. The original image was scanned at 300 dpi, so the image second from the left on the top row represents the original size and resolution. The raggedness that comes with a lower resolution is quite apparent. Note that this is only a concern when dealing with diagonal or curved lines.

One way to keep curves and diagonals as smooth as possible, assuming a 300 dpi scanner, is to scan the original at 200% of the size needed for printing, but use 600 dpi when actually printing the image. Of course a 600 dpi printer is required.

When printing a large raster image or several smaller ones on the same page, there is always the real danger of running out of printer memory. The situation can be remedied by cutting the resolution in half; e.g., from 300 to 150, and then using the **-s 50** flag on the command line to preserve the original size. The effect of this is to reduce the required printer memory to one fourth of what had been needed at the higher resolution.

The program will default to a 300 dpi resolution if the **-r** flag is absent from the command line. If a different default resolution is wanted, the environment variable PCLRES can be set to the desired value. An **-r** flag on the command line will override the resolution setting in the environment.

**Height and Width ( -h ### and/or -w ### )**

Rather than specifying the desired image size as a percentage of the original, the user can supply an absolute width or height on the command line and the program will make the necessary calculations, taking into account the resolution, to create the appropriately sized image. Usually, the **-h** or **-w** flags would be mutually exclusive on the command line; i.e., if the width is supplied then the height is calculated proportionally and vice versa. This is called "isotropic" scaling where units or dots are the same size both horizontally and vertically.

If both a width and a height are supplied on the command line, then there is a good chance that to fit the image to the specified rectangle, it will have to be scaled to different proportions on the width and height. This would be "anisotropic" scaling where the horizontal and vertical units of measure are different. Basically, the effect is to shrink or stretch the image in one direction or another. This is shown in Figure 4 where the image on the left side was generated using the command **mkpcl -u px -w 925 inputfile outputfile**. The resulting image is 925 dots wide as specified, and the height scaled to 770 dots. The command **mkpcl -u px -w 925 -h 600 inputfile outputfile** produced the corresponding image on the right. The second drawing has not been cropped in the sense of clipping off part of the image, but rather it has been squeezed together from top to bottom to conform to the 600 dot height specified on the command line. Depending on how you want to look at it, you could also say that the 600 dot height was specified and the image width was stretched to conform to the 925 dot width that was indicated. The scaling of the image height and width are two completely separate operations internally and one is not dependent on the other. The **-u** flag will be explained momentarily.

The default unit of measure used in the argument to the **-h** or **-w** flag is the inch, but other units are available and they are discussed in the description of the **-u** flag. The argument may contain a

decimal point indicating some fractional part of a user unit. However, all measurements are ultimately converted back to pixels, so to be meaningful the fractional component of the argument will have to represent a least one pixel.

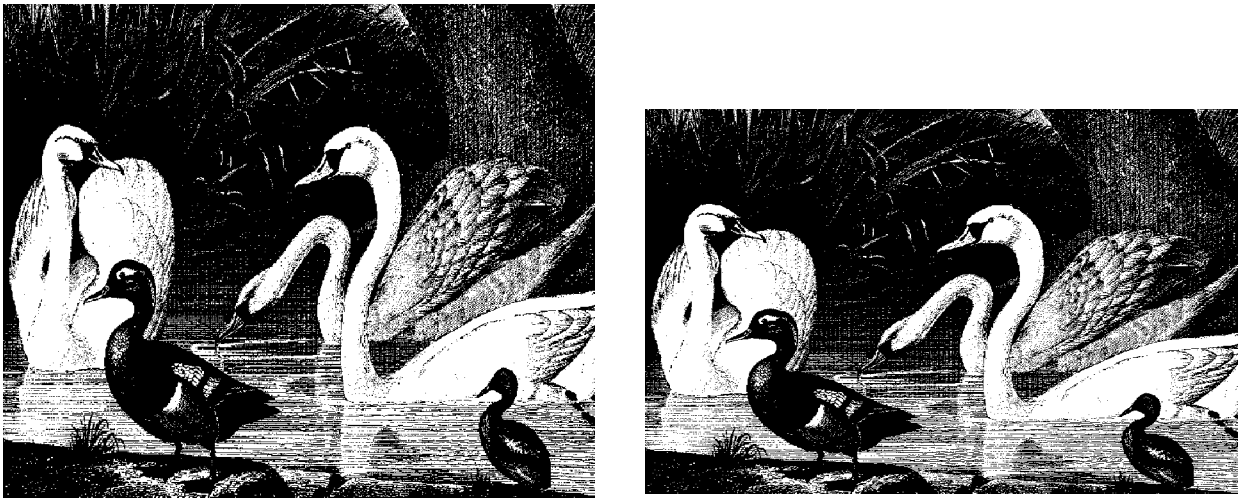


**Figure 4**

**User Units ( -u ?? )**

The unit of measure specified as an argument to the **-u** flag permits the user to define the image size in more convenient terms perhaps than printer pixels. This flag only has meaning when used when specifying an absolute image size on the command line in conjunction with the **-h** and/or **-w** flags. There are six different measuring scales available, each of which has a mnemonic abbreviation that will be used as the **-u** flag argument.

| | | |
|---|---|---|
| 1. | **in** | Inch |
| 2. | **px** | Pixel or printer dot |
| 3. | **cm** | Centimeter (Assumes 2.54 cm to the inch) |
| 4. | **mm** | Millimeter (Assumes 25.4 mm to the inch) |
| 5. | **pc** | Pica (Assumes six picas to the inch exactly) |
| 6. | **pt** | Point (Assumes 72 points to the inch exactly) |

If the **-u** flag is absent from the command line, the program will default to using the inch as the unit of measure. Note that the size of a pixel is determined by the resolution used and thus can vary from one invocation of the program to the next, whereas all of the other scales are absolute fractions of an inch. The term pixel is used here to avoid confusion with the term dot that may be used in the same frame of reference when defining a cursor location. Traditionally, there were 300 dots to the inch and we don't want to confuse that with the image pixel which may or may not be 300 dpi.

For an image 4.25 inches wide, type **mkpcl -w 4.25 inputfile outputfile**

For an image 10 cm wide, type **mkpcl -u cm -w 10 inputfile outputfile**

Substitute the appropriate mnemonic on the command line for the other measuring scales. The program recognizes the environment variable PCLUNIT and it will be recognized as the default unit of measure when set. To make the centimeter the default, at the prompt...

UNIX users type **PCLUNIT=cm; export PCLUNIT**
DOS users type **set PCLUNIT=cm**

An argument to the **-u** flag on the command line will override the environment setting.

**Border ( -b )**

This flag simply instructs the program to make all the perimeter pixels of the image black. This can greatly enhance the "look" of a grayscale image and is useful to determine the limits of a scanned image that has a white surround. To add the border to the image put the **-b** flag on the command line without argument. Figure 5 was created with **mkpcl -b inputfile outputfile**.

**Figure 5** – Adding a border

**Grayscale Tone Manipulation**

Unlike the black & white two color images we have looked at thus far, grayscale files are far more susceptible to differences in resolution, printer density settings, and other variations from printer to printer. The same image will probably be darker if printed at 600 dpi vs. 300 dpi on the same printer. Printer dots tend to "bleed" some and this is proportionately greater at higher resolutions. **Mkpcl** offers some command line options to modify the printed output.

**Brightness ( -B ### )**

Similar to the brightness control on your monitor, the brightness flag will lighten or darken the image. Note that the flag is a capital B. The argument is an integer and is a relative move from the current density. Positive values will lighten the picture and negative values will darken it. Grayscale files are capable of 255 intensities, and the value in the -B argument is added to the pixel value. The images in Figure 6 below had -B values (l to r) of -30, 0, and 30 respectively. Brightness defaults to a value of "0" if the -B flag is absent from the command line.

**6a** **6b** **6c**

**Figure 6** - Brightness Variations

You can clearly see the effect of the command. Also note that the darkening of the image in **6a** has created some unintended and unwanted tone in the background. In this instance the "-B -30" was probably a bit heavy handed for this illustration, but there are many occasions where you want to darken the image as much as possible while still retaining pure whites. This is addressed on the next page in the **threshold** description. The brightness option will NOT change pixels that have an original value of 0 or 255, so pure whites and pure blacks are still retained after a brightness change.

**Gamma or Contrast ( -g ### )**

The gamma flag permits the user to adjust the contrast of the printed image. Integer values in the range from 1-200 are allowed with a default value of 75. Generally, lowering the gamma value will render the image lighter and lower in contrast, and conversely raising the gamma value will produce a darker image with increased contrast. Contrast adjustments may be used in tandem with brightness changes. Very often you may find you need both an increase in contrast as well as a lightening of the image. In Figure 7 on the following page, the Caldera logo is shown with gamma values (l to r) of 50, 75, and 100 respectively.

**7a** **7b** **7c**

**Figure 7** - Gamma Variations

Again, the effect is readily apparent. Some color images may require a significant increase in contrast when rendered in grayscale. The color image can derive its perceived "bounce" from contrasting colors where the grayscale image must rely entirely on tonal variations.

**Threshold ( -H ###, -S ###)**

The threshold command can specify two different pixel intensities. There is a "highlight" as well as a "shadow" level, defined by the **-H** and **-S** flags respectively. The highlight threshold defines a pixel value, and any pixel in the image with a greater value will be "promoted" to pure white(255). Similarly, the shadow threshold also defines a pixel value, but values below it will be demoted to pure black(0). Referring back now to the dark image in Figure 6a, it is shown again in Figure 8a. If we run the same **mkpcl** command but add the **-H** flag to the command line, we can "restore" the white pixels back to their original values without affecting the darker pixels. In this example we had lowered the value of all pixels by 30 points, so considering that the maximum pixel value is 255, lets set our threshold to 220 and see if that cleans up the background. See Figure 8b.

**8a** **8b**

**Figure 8** – Highlight Threshold

This can very useful when working with ballpoint pen signatures that have been scanned in color. Ballpoint may not reproduce very well, as the line work tends to be broken and uneven. You can easily darken the signature and then clean up the background by setting a highlight threshold. While maybe not as common, a shadow threshold may save some thin lines or small text in an image that has been lightened. It may take a bit of trial and error to establish the needed value. If you are one point too high in the white threshold value, you get no effect at all. If you are too low you modify pixels that you didn't want to. The inverse applies when working with a shadow threshold. The main thing is to set your threshold right at the breakpoint so you don't change any pixels unnecessarily. Program default values are 255 for the highlight threshold and 0 for the shadow threshold.(No effect for either)

**Trim ( -t ), Trim Threshold ( -T ### )**

The trim option, when invoked by the **-t** flag on the command line, will "trim off" any surrounding "white" overscan from the image if it is there. Bytes are physically deleted from the output file if there is extra white around the image.

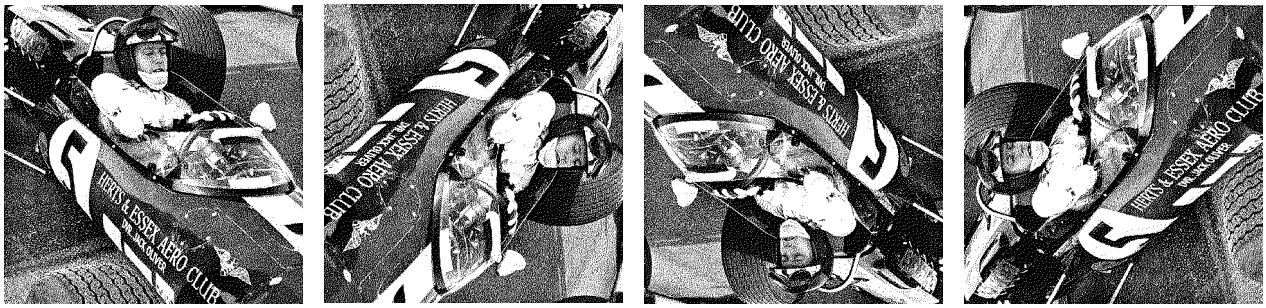
Aside from removing some "excess baggage" from the file, the trimmed image is potentially easier to size to a specific dimension than its untrimmed counterpart. No argument is required to the flag on the command line. The command **mkpcl -t -b inputfile outputfile** produced Figure 9 below. Compare that to the untrimmed version in Figure 5. The border has been included for comparison purposes only. Note that when the **-t** flag is used together with the **-w** or **-h** flags, the image will be sized based on the trimmed image; i.e., the image is trimmed before any size calculations are made.

**Figure 9** – Trimming the image

The **-T** option is used in conjunction with the **-t** flag to set a trim threshold on grayscale images; i.e., both the **-t** and **-T** ### are used together on the command line. The trim function processes the original image before any highlight adjustments are made and likely would not be effective on a grayscale image because the brightest tone or intensity in the image is something less than pure white. Similar to the highlight threshold command, the argument to the **-T** flag defines the pixel intensity considered pure white for trim purposes. This has no effect on the rendering of the image itself, just the criterion used to trim off excess background. This is very useful when working with signatures that have been scanned in color. Signatures in particular are much easier to position and size with all the overscan removed. Invariably the background tone is something "less" than white and it will not trim with the **-t** flag alone; however, the addition of **-T 210** to the command line may do the trick. A little experimentation will give you a feel for the needed value. For example try **mkpcl -t -T210 -b inputfile outputfile**. If the border still includes background beyond the signature on any of the four sides, use a lower threshold and try again. Of course, you would remove the **-b** from the command line once the result was satisfactory. Once in a while you will find a "blob" of some kind in the overscan area that prevents the trim function from operating as wanted. In that case, take the original file into a "paint" program and erase the offending mark.

**Rotate ( -R ### )**

The entire image can be rotated to 0, 90, 180, and 270 degrees in the clockwise direction, where 0 degrees would be considered with the top of the image pointing "north". Likewise rotating the image to the 90 degree position puts the top to the "east", 180 has the top pointing "south", and finally the 270 degree position puts the top to the "west". See Figure 10.



**0°** **90°** **180°** **270°**

**Figure 10** - Image Rotation

The argument to the **-R** flag is the angle of rotation. Note first that the flag is a capital letter and shouldn't be confused with the lower case counterpart used for image resolution. Second, 0, 90, 180, and 270 are the only valid arguments. They represent the four compass positions and any other values will result in an error. **mkpcl -R 90 inputfile outputfile** would be the required command to rotate the image to 90 degrees. The default is 0 degrees. The width specified on the command line will refer to the image width before the rotation takes place and likewise for the height.

**Save/Restore Cursor ( -d )**

If the **–d** flag, without argument, is included on the command line, the program will add the appropriate PCL code to the output that saves the “current active position” or CAP, before the image is printed. Then after the bitmap has been imaged, the CAP is restored to the previously saved address. The save will happen before any **–x** or **–y** values are encountered. This is very useful if you are printing the image with other text. It means you can specify an absolute address for the image without disturbing the location of your current text. This scenario is most likely to play out when you are calling the image as a macro. Effectively, the image is printed , but the underlying application is “unaware” of it. See the discussion on macro execution in “Application Guidelines”.

**Watermark (-W ###)**

The watermark flag defines a gray level to reproduce the black in a bi-level file. Instead of printing your logo as solid black, you can print it in any shade of gray you select. The argument to the flag is the desired pixel intensity in the range 1 to 254. Remember, 0 represents pure black and 255 is pure white. Values outside the 1-254 range will cause the flag to be ignored.

Often you will find that a graphic reproduced as black will be too overpowering, and rendering it as a shade of gray will give a more pleasing image. Figure 11 below shows our Spectra logo at the indicated shading levels, both at 300 dpi and 600 dpi. **mkpcl -W 120 inputfile outputfile** would set a gray level of 120 at 300 dpi. **mkpcl -r 600 -s 200 -W 120 inputfile outputfile** would be in order at 600 dpi. **-s 200** is included to preserve the image size.

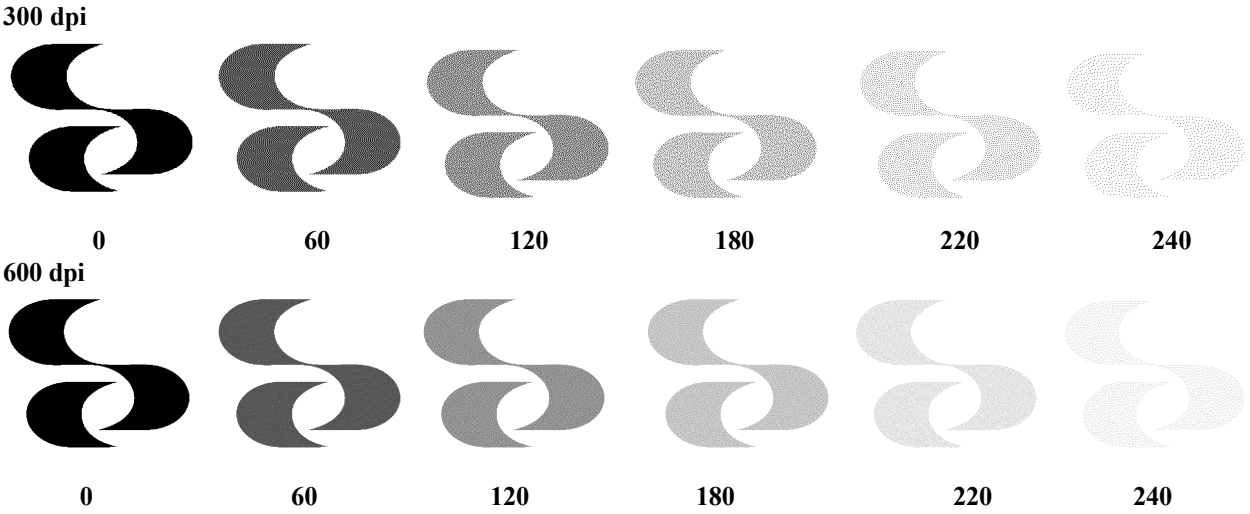



**Figure 11** - Wartermark Variations

Note how coarsely the dithering algorithm has rendered the lighter shadings of 220 and 240, whereas the the same shading at 600 dpi significantly better. This provides a simple mechanism to "ghost" an image in the background of an invoice or purchase order etc. Alternatively, you can start with a black image and have PCL use a gray or some other pattern as the fill.

**Flop Image (-f)**

This option flops the image over left to right, and is invoked by including the **-f** flag without an argument on the command line. If the flop option is used with an image rotation, the image is first rotated and then flipped over.

**Figure 12** – Flopped Image

**Invert Image ( -i )**

The invert option reverses the state of each bit in the image, effectively creating a negative of the original. If the **-i** flag is present on the command line the image will be inverted. This option may be more useful than would be immediately apparent primarily because bitmap files are typically written for video display where a bit that is "on" will display as white, just the opposite of the printer's behavior. Programs like **mkpcl** normally invert the image as a matter of course.

**Figure 13** – Inverted image

When the **-i** flag is present on the command line, the image is inverted before any trimming of the image that may be called for. Image inversion directly affects the "trimability" of any image, and any image that would trim without inversion will not trim with it.

**Crop Image ( -C ###,###,###,### )**

The **-C** option crops the image per the user's specifications. The flag takes four comma separated arguments that are the desired coordinates, in pixels, that represent the area of interest of the image in the form **-C x-begin,x-end,y-begin,y-end**. No spaces are permitted within the argument. The values are in pixels measuring from the top left of the image. Consider the image to be a two dimensional array of pixels. We can specify the desired crop area by defining the beginning column on the left followed by the ending column on the right and then similarly the first and last row. The first element on either axis is **1**.

For example, assume our original BMP is 1200 pixels wide by 700 pixels high. If we want to crop out of that pixels 230-1050 on the X-axis and rows 40-640 on the Y-axis, the command **mkpcl -C 230,1050,40,640 inputfile outputfile** would produce the desired output. To establish the desired coordinates, first print out a copy of the uncropped image on the printer at 300 dpi, the **mkpcl** default. Issue **mkpcl inputfile outputfile** and then print the output file. Print the file included in the distribution named "ruler.pcl", a ruler with a 300 dpi measuring scale. With the 300 dpi ruler you can very quickly establish the crop parameters. Laminate and trim the ruler if you can. All subsequent sizing of the image is based on the crop and not the original.

**Color Index ( -I ## )**

It is possible with a PCL5 color printer to print a monochrome image in a color other than black. Note that this includes all of the PCL5 color LaserJets and all of the PCL5 DeskJet printers. These DeskJets include the 2250, 2280, 2300. This will NOT work on the PCL3 DeskJets which includes the vast majority of HP inkjet printers.

Included in the files in the distribution is 'colors.pcl' which is reproduced in Figure 15 below. Print the file on your PCL5 color printer. It is shown here purely for reference and any judgment of color fidelity and accuracy should be made from your printed copy. In any case you will see that the sheet contains 100 copies of our Spectra logo, individually numbered 0-99. There are 10 different colors, each at 10 different densities. The number below each logo is the argument required for the **–C** flag on the command line.

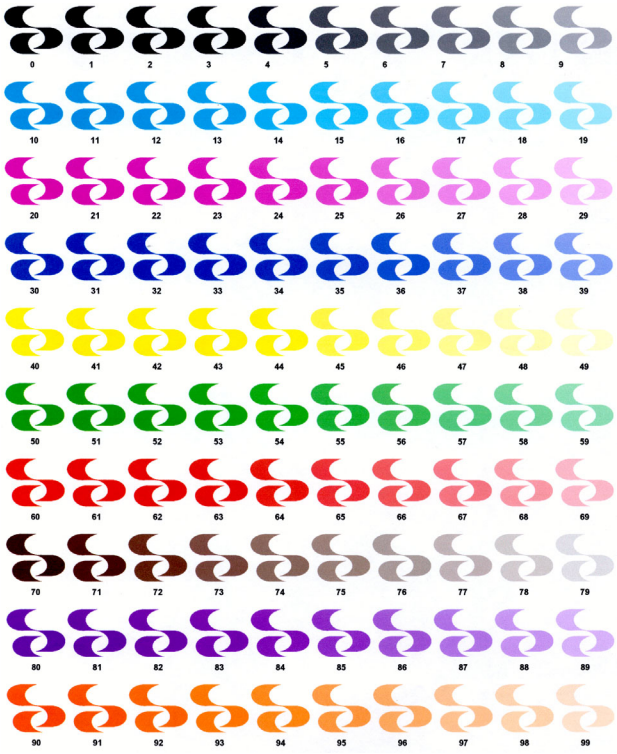


**Figure 15** – MKPCL Color Indexes

**mkpcl –I 57 inputfile outputfile** would produce a green image similar to logo 57 above. Of course the color accuracy would be 100% when compared to the color sheet that you had printed for reference. This could be an excellent method for creating watermarks. If you want to make a tinted watermark, use one of the lighter colors here WITHOUT the **–W** flag that you would use in black and white. If you need to reproduce an image that is monochrome, but a color, there are immense savings in image size printing it this way rather than as a full color image .

**Limit ( -L ###.##,###.## )**

The limit option came as the result of a customer request. It specifies two dimensions in the form **-L maxwidth,maxheight**. This represents the maximum size the image is to be in either direction; i.e., if the image is sized to **maxwidth** and the height scales to greater than **maxheight**, then it will be resized to fit the depth with a correspondingly narrower width. The parameters are comma separated and no spaces are allowed. The values are stated in user units and fractional components are permitted where applicable.

Given a 2.75 wide x 1.75 inch high area printing, **mkpcl -u in -L 2.75,1.75 inputfile outputfile** will always produce an output image that fits the allocated area, so it could be run from a script and process a number of originals without operator intervention. If you have to contend with a variety of sizes and shapes of originals, **mkpcl** will insure the image fits within the limits of the defined box.

**Printer Macro ( -m ###, -p )**

The output file can be formatted for downloading to the printer as a macro and then later executed by the application or enabled as an automatic overlay. See the "macro example" later in this manual for macro details. To create a macro file, simply add the **-m** flag to the command line with an integer from 1 to 32767 as the argument. This number will be the Macro ID unique to this macro that is referenced later when it is run.

For example, **mkpcl -m 1636 inputfile outputfile** would create a PCL file that would store macro number 1636 in the printer's memory once it was downloaded. Then, at the appropriate time the underlying application would issue the "execute macro 1636" command at which time the graphic would be integrated into the current page being printed. If the macro option is used the following is sent to the file, using **-m 1636** cited as the example.

1. Delete macro 1636 if it exists
2. Begin definition of macro 1636
3. Image data
4. End macro 1636 definition

Without the **-m** flag, only the image data(3) would go into the output file, and with it commands 1, 2, and 4 are added. Once downloaded, the macro will exist in the printer until it is powered off or reset. A normal print job would reset the printer when finished and the macro would cease to exist. If the **-p** flag is added to the command line, then one more command is tagged on to the end of the file. The **-p** flag is ignored in the absence of the **-m** flag.

5. Make macro 1636 permanent

A "permanent" macro will survive a printer reset; however, it will disappear if the printer is powered off. The company logo could be downloaded to the printer in the morning as a permanent macro and be available to all users throughout the day. There is always the danger that the printer is shut off for some reason during the day or the macro itself is deleted. In addition, macros occupy printer memory, and if memory is tight you certainly don't want it filled up with everybody's macros.

**Cursor Positioning ( -x ###, -y ### )**

Without intervention from the application, the graphic file will be printed on the page wherever the printer cursor happens to be at the time. In most applications, it is quite likely that the cursor would first be purposefully positioned and then the graphic image would be printed. No cursor positioning commands are necessary within the graphics file itself.

If the graphic is being enabled as an overlay, i.e., the printer is going to automatically print it on each page, then a cursor positioning sequence will need to be contained in the macro to locate the image at the desired spot on the page. The **-x** and **-y** flags provide a mechanism to insert positioning codes into the print file.

The argument to the **-x** flag is the desired location of the image along the horizontal or X-axis and likewise, the **-y** flag's argument defines the vertical or Y-axis location. If the argument to either flag is unsigned(no + or - ), then it will be interpreted as an absolute position that is "x" dots to the right and "y" dots down from the top left margin. That is a "very likely" scenario in the case of an automatic overlay. Lets say the logo wants to be located one inch from the left margin and two inches down from the top margin. Assuming a 300 dpi addressing scheme in the printer, **mkpcl -x 300 -y 600 inputfile outputfile** would create an output file with the correct positioning code inserted in front of the graphic. If a printer macro is the desired output, then **mkpcl -m 1636 -x 300 -y 600 inputfile outputfile** would be an appropriate command.

If the argument to either flag is preceded by a "+" or "-" sign, it will be interpreted to mean that cursor is to be positioned relative to the current cursor position(CAP). It is quite common to have an absolute position on one axis and a relative position on another.

**mkpcl -x 1050 -y -50 inputfile outputfile**

moves the cursor 1050 dots from the left margin and 50 dots up the page from the CAP. Absolute positioning on the X-axis is commonly used to preserve column alignment. Relative positioning codes are very useful to slightly "tweak" the general location on the page where the graphic will be printed. This location is largely determined by whatever else is being printed on the page. For relative moves, on the X-axis -values move the cursor left and +values move it right. On the Y-axis -values move up the page and +values move the cursor down the page.

**Presentation Mode ( -l # )**

Raster graphics are printed in portrait orientation, regardless of the orientation of the logical page. So if you print an image on a landscape page, without intervention, the image would still print in portrait orientation appearing “sideways” on the landscape page. PCL code can be added to the stream that instructs the printer to rotate the image to the current orientation automatically, or the image can be rotated so when it is printed as portrait, it still "reads" properly when viewing the landscape page. It is most efficient for the printer if an image is printed in portrait orientation.

The **-l** (ell) flag can be included on the command line to let you choose the preferred behavior. Only values of **0** or **1** are permitted. An argument of **0** will leave the image untouched and a **1** will cause the image to follow the orientation. The default is **1** , which means that it is unlikely you would ever have a problem if you ignored this flag altogether.

**Runtime Display (-v #)**

At runtime, various messages are displayed on the screen that track the program’s execution progress. This is pretty standard and what we expect. For most users this flag can probably be ignored. The text below shows a typical display.

```
# mkpcl -c4 -s 135 logo.bmp logo.pcl
Reading Source File...

               logo.bmp                    logo.pcl

               Current Width               Width at 135%
                  408 Dots                    551 Dots

               Current Height              Height at 134%
                  321 Dots                    433 Dots
Scaling Image...
Dithering...
Generating output...
100% Complete

Sun Oct  2 11:13:55 2005
mkpcl -c4 -s 135 logo.bmp logo.pcl
No Errors - Normal program termination!
#
```

For reference, the command line is shown at the top. The information displayed is determined by the command line contents. Input and output image sizes are shown first, followed by the applicable program functions as they are executed. This culminates with “Generating Output” that builds to 100%. The output file is complete at this point. The final three lines contain a timestamp, a copy of the command line, and a message confirming the successful execution of the program.
If the program encounters an error while running, an error message will be shown in the third line.

The **–v** flag allows the user to suppress the top, bottom, or both sections altogether from being displayed on the screen. The flag takes a numeric argument from **0-3** that has the following effect.

**0** – Display both top and bottom sections (default)
**1** – Suppress all display
**2** – Display only top section (Suppress bottom)
**3** – Display only bottom section (Suppress top)

If the argument to the flag is outside the **0-3** range, the program will print a warning and revert to its default of **0** (display both sections), and carry on as normal. If you prefer a default **>0**, the program respects the environmental variable **PCLQUIET.** Set it to **1, 2, or 3** as needed, and this will become your new default. To set the new default to **1** …

| | |
|---|---|
| UNIX users type | **PCLQUIET=1; export PCLQUIET** |
| DOS users type | **set PCLQUIET=1** |

A command line option overrides an environment setting. For those of you creating logfiles, the top section of the display is sent to **stdout** while the bottom section is directed to **stderr**. All error messages are sent to **stderr** as well, so a logfile can be derived from the output of **stderr**. Now if you don't want to include a record of successful program executions, simply put **–v 2** on the command line and those messages will not be generated.

**Help ( )**

To get help online, **mkpcl** without argument will display the following:

```
                USAGE: ./mkpcl [ -options ] inputfile outputfile
                       ./mkpcl without argument for help

                   M K P C L   P R O G R A M   O P T I O N S
-------------------------------------------------------------------------------
-b      Put border around image         -m ###  Output as macro ###
-B ###  Brightness adjustment           -p ###  Make macro permanent
-c #    Compress 0, 2, 3, 4             -r ###  Resolution in dots per inch

-C #,#,#,# Crop image                   -R ###  Rotate image 0, 90, 180, or 270
-d      Save/Restore cursor(CAP)        -s ###  Scale to ###% of original size

-f      Flop image left to right        -S ###  Shadow threshold
-g ###  Set gamma value                 -t-T### Trim overscan, Trim Threshold
-h ###  Image height in user units      -u  ??  User units px,in,mm,pt,cm,pc

-H ###  Highlight threshold             -v #    Limit runtime display messages
-i      Invert to negative image        -w ###  Image width in user units

-I ##   Color Index (0-99) See Sample   -W ###  Watermark Tone (1-254)
-l #    Rotate to page orientation      -x ###  X axis positioning in dots
-L #,#  Limit output size               -y ###  Y axis positioning in dots
-------------------------------------------------------------------------------
```

**Error Logging**

There are roughly 50 error conditions that can cause **mkpcl** to abort its execution. Most of these are "pilot error" where a bad or illegal argument is given to an option on the command line; consequently, errors are relatively rare. When an error is encountered, an error number and a brief descriptive message of the problem is displayed. Below is a list of the error codes and descriptions.

| Error No. | Description |
|---|---|
| 0 | Too few arguments on command line |
| 1 | Bad command line syntax. Invalid option or missing argument |
| 2 | Invalid program option |
| 3 | Same name for input and output file |
| 4 | Invalid program option |
| 5-10 | Boundary limit error |
| 11 | Invalid unit of measure |
| 12 | Invalid landscape specification |
| 13 | Invalid trim threshold |
| 14 | Gamma value out of range |
| 15 | Macro ID out of range |
| 16 | Size specification too small |
| 17 | Foreground color out of range |
| 18 | Invalid compression number |
| 19 | Invalid rotation angle |
| 20 | Invalid resolution |
| 21 | Invalid watermark value |
| 22 | Cannot open input file |
| 23-25 | Memory allocation error |
| 26 | Cannot create temp file |
| 27 | Cannot create temp file |
| 28 | PCX plane count. Must be 1 or 3 |
| 29 | PCX file or memory error |
| 30-34 | Output size out of bounds |
| 35 | Cannot open output file |
| 36-43 | Memory allocation error |
| 44 | Unknown input file type |
| 45-52 | Bad cropping parameters |
| 53 | Incompatible BMP compression or plane count |

When an error is encountered, three lines are displayed; a timestamp, a copy of the command line, and the error message. While this may seem to be an over abundance of information to display a simple error, it is useful if you run **mkpcl** from a script and save errors to a file. The command "**mkpcl –options inputfile outputfile 2>>/tmp/errlog**" would redirect and accumulate error messages to the file "/tmp/errlog". Program success will also be posted to the display or logfile.

**Application Guidelines**

A raster file is either imaged by the printer immediately as the data is received, or it is downloaded to the printer as a macro, and is then processed at some later time. In most instances it is not very practical to download a file in the middle of the data stream. Further, many applications do not provide the functionality to make timely downloads to the printer. Ideally, all necessary macros would be downloaded to the printer at the beginning of the job.

A macro provides alternatives for the application to utilize the bitmap, and would most likely be the preferred approach. In the macro scenario, the image is sent to the printer with its embedded unique Macro ID. This download of the image to the printer can happen at the beginning of the print job or it could be first thing in the morning for a job that is going to be printed sometime later in the day. If the macro was defined as permanent, then only a loss of power to the printer or an explicit delete or replace macro command will change the macro's status. In the worst case where the application provides no way to send a file to the printer on demand, you can simply use your standard "print" command to direct the macro to the printer before your application is started. Nothing will physically print at this point.

Once the macro has been sent to the printer, your application only needs to send a short PCL command to either execute the macro or enable it for automatic overlay. We will look at each of these alternatives in detail in a moment. Your application must have the facility to permit PCL code to be inserted in the middle of the job. In addition, as part of the PCL code, you have to be able to enter the "escape" character, chr$(27) in basic, 0x1B in hex, \033 in octal, and of course 27 in decimal. In the examples here, the "escape" is shown simply as **<esc>** in the code, but it still refers to the real escape character. Fortunately, the balance of the PCL code is all ASCII characters. A macro can contain any valid PCL code as well as bitmaps.

From this point forward it is assumed that macro 1636 has already been downloaded and was declared as permanent when **mkpcl** created the macro. As long as they each have a unique ID, several macros can be resident in the printer simultaneously, largely limited only by the amount of printer memory.

**Automatic Overlay**

When enabled as an automatic overlay, the macro code will be run as the very last thing before the page is actually printed and ejected from the printer. To enable a macro as automatic, we need to insert somewhere on the page **<esc>&f###y4X**, where ### represents the Macro ID number that was assigned when **mkpcl** was run. So in the example at hand we would issue **<esc>&f1636y4X**. Once enabled the overlay will be run on every page until the overlay is explicitly disabled, a different macro is enabled, or the printer is reset. To disable the overlay, issue **<esc>&f5X** anytime. The ID is not required to disable, as only one macro can be enabled at any given time.

Because the overlay is run after the PCL page has been imaged, you must supply PCL coordinates to position the bitmap on the page. Do this with the **-x** and **-y** flags on the **mkpcl** command line when the macro is created. One advantage of the automatic overlay is that you needn't concern yourself with the cursor's position once the image has been laid down as the cursor is reset when the page is printed. The overlay is particularly ideal where you have a logo or some other item that is displayed at the same location on every page.

**Macro Execution**

When a macro is "executed", it is immediately run at the location where the execute command was encountered on the page. A macro is executed with the command **<esc>&f###y3X** where ### is the macro ID, thus the command for the image at hand would be **<esc>&f1636y3X**. Once the macro has been run, the cursor remains at the bottom left of the image, and this has probably put the cursor "out of sync" with the application. What we can do is save the cursor address before the image is laid down, and then restore the cursor back to its original location when done. Our application is none the wiser. The command **<esc>&f0S** saves the current cursor location and **<esc>&f1S** restores the cursor to the last previously saved address. This means that you could embed X,Y coordinates in the bitmap itself or you could supply the positioning codes from within your application.

If macro 1636 contains X,Y code within, **<esc>&f0S<esc>&f1636y3X<esc>&f1S** would save the cursor, run the macro, and restore the cursor back to the point we started at. Let's say we wanted to print at location 400X 1200Y. Rather than have the XY code in the macro we could position it within the application, but remember to save the cursor beforehand. In this case we could issue **<esc>&f0S<esc>*p400x1200Y<esc>&f1636y3X<esc>&f1S** and the image would be positioned as desired. Sometimes the print location is determined by the data on the page and can only be established at runtime. For example, this could be a signature at the end of some text of undetermined length. In this case we probably always want to print at the same X location, but the desired Y location is relative to the end of text. If our PCL command is issued right at the "end of text", we can use a relative positioning code for the Y-axis.

The code **<esc>&f0S<esc>*p400x+50Y<esc>&f1636y3X<esc>&f1S** will position the image 50 dots below the point the macro call was encountered with the cursor eventually restored to the calling point.

Macros can be nested, so if you have a macro to overlay an invoice form, you would have the invoice macro execute the logo macro as part of the form. The logo macro would have no internal positioning codes. This way, a single logo macro could be used on any number of forms and only require a single download. Also, an image can be repeated on the same page just by executing the macro at different locations. An automatic overlay that contains all of the static information on the printed page can immensely reduce the complexity of the application as the overlay might be able to relieve the application of font changes and other PCL overhead.

**A Macro Example**

To tie all of this together, we will create a letterhead macro that will be used as an automatic overlay. The entire demonstration will require a total of three files.

1. **lhead.mac** the main letterhead macro
2. **logo.mac** a logo macro executed by lhead.mac
3. **demo** the application that calls lhead.mac

Although it is not shown at actual size, below is a copy of the completed macro. You can see that there are three elements, the logo, some text, and a line.

The entire operation is controlled by the "lhead.mac" file. With the exception of the logo, all of the PCL code in the macro can be entered with a text editor. The escape character is shown as **^[** in the listing below. This is how it is represented by the vi editor. Remember that this is a single character in the file. The line numbers are for display here and are not part of the file.

```
1. ^[&f1636y0X^[&l6d0e66F^[(s1p20v0s0b4197T
2. ^[*p475x285YSpectra Colour Services Ltd.^[(s12V
3. ^[*p475x352Y      Box 2 - 10688 King George Hwy, Surrey...
4. ^[*p300x385Y^[*c1960a7bP
5. ^[*p60x85Y^[&f100y3X^[&f1X^[&f1636y10X
```

The first line begins ^[&f1636y0X. This is a begin macro definition command. The value preceding the "y" is the macro ID and 0X indicates begin macro definition. Next is a page formatting command. The "0e" in the middle of the string specifies there is NO top margin. This format is only for the macro itself, and not the page format for the application that will later use the macro. This is done so we can print overlay items in the application's margins if desired. The final item on the line is the sequence to call up 20 pt. Garamond for the "company name".

Line 2 positions the cursor, prints the company name, and reduces the point size to 12 pt for the address and phone numbers which are positioned and printed on the third line. Some of the actual address text has been deleted here to make it fit on one line. The complete text is in the lhead.mac file. The fourth line positions and prints the horizontal line with a PCL sequence.

Finally, on the fifth line, the logo is positioned, and then "printed" by executing macro 100, which we will create in a moment. This is followed by ^[&f1X which is the "end macro definition" command. The last sequence declares macro 1636 as permanent.

**Logo Macro**

Create the logo macro with **mkpcl** using the supplied logo.bmp file as the source. Enter the command as follows:

**mkpcl -c4 -t -m 100 -p logo.bmp logo.mac**

This will create "logo.mac" with a macro ID of "100" and will be marked as permanent when it is sent to the printer.

**Test File**

Using your text editor, enter the following into a file called "demo":

```
^[&f1636y4X
^[*p825x1200YTest of letterhead macro.^L
```

Remember that the **^[** represents the escape character. Save the file and we can go on to test the macro. The first line enables macro 1636 for overlay, and the second is just frivolous text with associated positioning code. At the end there is a formfeed, shown as ^L. You would enter ^L in "vi", but do whatever you need to with your editor to get char 12.

**Putting it to Work**

Direct both logo.mac and lhead.mac to your laser printer using the appropriate "print" command for your computer system. While these macros are in separate files here, several macros could be contained in a single file, thus requiring only a single download for all of them.

Now print the **demo** file, and you should have the letterhead nicely printed at the top and the sample text down towards the center of the page. Change the text and print it again. If you haven't shut off the printer in between, the letterhead should print again without a reload.

**Conclusion**

You can create sophisticated applications that require little PCL code to implement. Consider that you can have several macros downloaded and resident in the printer. Then some logic in the application can execute the overlay containing the logo or form that is appropriate based on some criterion contained within the user data. A simple example might be an invoicing routine that overlays an "invoice" form for positive amounts, but overlays a "credit note" for negative amounts. Start out with modest goals, and build on it from there. This discussion is largely beyond the scope of **mkpcl** itself, which is simply another tool used to achieve your intended goal.

**FilePro Usage**

Inserting a bitmap graphic into filePro output requires three general steps. First, the CAP must be moved to the position on the page where the graphic is to be printed. The initial position marks the top left corner of the bitmap image. Then the file containing the image is sent to the printer, and finally the CAP may need to be relocated on the page to continue printing the balance of the page.

To position the cursor, simply send the appropriate PCL escape sequence to the printer that sets the CAP as desired. It is possible that the CAP may already be where you want the image printed by virtue of having the graphic downloaded at an opportune time in the filePro data stream, although, that probably isn't practical most of the time. The graphic file itself is sent to the printer using the "download" feature available in printer maintenance which is implemented as a printer code on the print code table. You define in printer maintenance a print code in the form

**%"pcl_filename"**

The quotes are required and the filename can be either a complete path to the file or a relative path from the 'download' directory. By default the current directory is used but you can change the default by setting the environment variable PFDLDIR. The print code for the download can be located anywhere on the output format from the printer's standpoint, however, if the graphic was to only appear on the first page of the job then the download would have to be executed during the format init or some other creative method would have to be implemented to insure the file was only sent to the printer the one time.

Once the printer has imaged the graphic, the cursor remains at the bottom left of the image. In most cases this will have put the cursor out of sync with the regular filePro data. The most straightforward approach to restoring the cursor is to simply use PCL codes to save the cursor address before the graphic is downloaded and then restore the cursor back to that position after it is printed. An example should make this clear.

Assume that we have created PCL printable file of our logo and it resides in the file **logo.pcl** that is located in the default download directory. Further, we would like to print the logo at location 200X 400Y on every page. If print code number 75, for example, is defined as

**$1b &f0S $1b *p200x400Y %"logo.pcl" $1b &f1S**

you could put print code 75 anywhere on the output format and the logo would be properly positioned and subsequent filePro data would be located correctly as well. Note that the above code is what would literally be entered into the print code table and would be defined as non printing or not requiring a space to be allowed for it. Now an explanation.

**$1b &f0S** is the PCL sequence to store the CAP or to "push" it onto the "stack". Saving the CAP in itself does not change the CAP.

**$1b *p200x400Y** moves the CAP to locate the graphic on the page.

**%"logo.pcl"** downloads the logo.pcl file to the printer. At this point the CAP is at the bottom of the logo.

**$1b &f1S** restores the CAP to the address previously saved or "pops" the previous address off the "stack". At this point the cursor is now located back to where it was before the print code was encountered so subsequent filePro data will be unaffected by virtue of the logo having been printed.

All of the cursor positioning code can be added to the graphic file itself, thus requiring only the download command to appear on the print code table. The **-x** and **-y** flags can be used in **mkpcl** for this purpose. It would need to be wrapped with the save and restore cursor codes, but that is easily done with the **–d** flag on the command line. The only drawback to that approach is the file is made inflexible for other uses. In this regard, though, there is a public domain "vi" clone called "vim" that has some useful attributes. It has a binary mode and will not swallow 0x00 characters, line lengths of several megabytes are allowed, and line wrap can be disabled. These three features make minor surgery on a PCL bitmap very easy.

You will find that it is most practical to test the positioning codes etc. by editing the file and printing with the 'lp' command. Put the image into filePro only when you are certain that you have what you want. It will save you a lot of time in development.

**FilePro and PCL Macros**

To demonstrate the ease of implementing printer macros with filePro, we will setup the letterhead macro previously created, for use in any of your output formats. It is assumed that PFDLDIR has already been set in the environment.

This is short and sweet. First, define a printcode to download **lhead.mac** and **logo.mac** to the printer, let's say code #65. Define it as requiring no space in the first field, and then for the "business" part of the code enter **%"lhead.mac" %"logo.mac"**. Now quote code 65 as the form init code on the F8 options page in define output on the target format. This will download the macros to the printer at the beginning of the job.

All that remains is to put a variable on the output format that enables or disables the macro for overlay on the page. Call the variable **ol(10,*,g)** and in processing make the following assignments. If you want the letterhead to be printed on the current page, set **ol=chr("27"){"&f1636y4X"**. Once **ol** has been sent to the printer, the letterhead will appear on every page. To disable the overlay set

**ol=chr("27"){"&f5X"**. Depending on the contents of **ol** you can elect to print the letterhead or not. There is a good chance that you only want the letterhead on the first page. In the case of a report, you would need to keep track of the current page number, and then populate the variable as is appropriate. Once disabled, the overlay will remain disabled until it is explicitly enabled again.

On a full page form, place **ol** anywhere that is convenient. On a report format put **ol** somewhere in the heading and it will only appear once on the page. The variable only needs to be set when you are changing the state of the overlay. The processing should be designed to make **ol** null on any page where you aren't enabling or disabling the overlay.

**HP DeskJet Printers**

The key to successfully merging graphic images into filePro output formats is maintaining the correct alignment of the filePro data on the printed page after the graphic has been imaged. This is relatively easy with a laser printer because the entire page is stored in the printer's memory before the page is physically printed and the cursor can be relocated at any time. **Note that PCL3 printers do not support printer macros.**

**Mkpcl** was written specifically with LaserJet printers in mind, and traditionally merging text and graphics using one of the less expensive DeskJet printers was tedious at best and probably impossible in practicalities in the context of filePro. The newer DeskJet models give the filePro user a means to insert graphics and still maintain alignment with the database data. This applies to the DeskJet 540, 6xx Series, and the 8xx Series and later only. For other models in the 5xx Series, this simply won't work. Sorry! While these DeskJet models cannot store in memory an entire page of text and graphics, they can and do store the entire page of text before the page is printed. This presents the opportunity to position the cursor anywhere on the page and print a graphic **after** the text has been processed. Duplicating the example used previously with the LaserJet, to print the logo on the DeskJet printer we would first need to create the following print code in printer maintenance.

**$1b *p200x400Y %"logo.pcl" $0C**

This code is placed on the output format on the last character of the last line and the page should print just as it did with the LaserJet. Briefly, the codes do the following.

**$1b *p200x400Y** moves the CAP to position the graphic on the page.

**%"logo.pcl"** downloads the logo.pcl file to the printer.

**$0C** is simply the hex code for a formfeed that ejects the page from the printer.

The DeskJet printers do not support the save and restore cursor commands as do the LaserJets, so the recommended procedure is to send the formfeed immediately after the graphic has been imaged. This creates a problem for filePro, not on the page that was just printed, but rather any subsequent pages. Consider the timing of the execution of our print code with the code placed on the last character of the last line. Once the code is finished filePro still has to print the final character as well as the LF/CR for the last line. The problem is that the print code has already had the printer eject the page, thus the trailing LF/CR etc. end up on the next page. The last character is eliminated by defining the print code as occupying space on the format, but that still is no help on the trailing LF/CR. Define the printcode as occupying a space.

The solution to this dilemma is to add another print code to the format that homes the cursor to position 1,1 on the format. Put the code at 1,1 and define it in printer maintenance as follows:

**$1b &a0R $1b *p0X**

**$1b &a0R** moves the CAP vertically to the baseline of the top row.

**$1b *p0X** moves the CAP to the left margin.

There seems to be a bug in the PCL3 DeskJet firmware. Where **$1b &a0R** is supposed to locate the cursor on the first row below the top margin as it does on a LaserJet, on every DeskJet we have tested, it positions relative to the top of the physical page rather than the top margin. You may find that **$1b &a3R** is wanted when working with a default half inch top margin. A little experimentation will quickly show the needed value.

The actual implementation in real output formats is quite likely much simpler that it may read here, particularly when defining a form as opposed to a report. Report formats present a problem in that the print code to download the graphic etc. must only be executed at the end of the last text line of the format. Even if the graphic is to appear in the heading area of the page, the print code to create it must still be placed at the end of the text. Because the code cannot be placed in the page heading, some means to conditionally execute the code using @LC in conjunction with not printing blank lines perhaps, will have to be implemented in processing.

For example, assume that two data lines in a report format were defined as:

```
-------------------------------------------------------------------------------------------------------------
*aa                    *bb                *cc          *dd
*ee                    *ff                *gg          *hh          printcode
-------------------------------------------------------------------------------------------------------------
```

Each of these lines is formatted to contain identical data, except that the second line would have the graphic print code placed at the end of the line and would only be used when the final line on the page was being processed. As the page was being printed the variables **aa - dd** would be loaded with the appropriate values while **ee - hh** would be null. However, when the last line was to be printed, the variables **aa - dd** would be nulled while **ee - hh** would be loaded with the relevant values. Assuming that the format was defined to NOT print blank lines, then the graphic should print as desired. An additional check would be needed in processing to make sure that the print code was executed on the last line of the report if the last page isn't filled. If it is necessary to print a blank line, define another format line only containing a single character variable. When a blank line is wanted, load the variable with chr("13") otherwise make it null.

The use of this technique, and others no doubt, permits the filePro programmer to generate very sophisticated reports that might seem impossible with filePro at first glance. Certainly the usefulness goes far beyond conditionally executing a print code.

**Getting Help**

The best way to learn is through experimentation. Because of the flexibility afforded both by filePro's output formats and the PCL language itself, there is usually more than one way to accomplish your print requirements. There is a wealth of information in the PCL 5 Technical Reference Manual Set available from Hewlett-Packard. If you are stuck, send email to jim@spectracolorservices.com and describe what you are trying to do and where you are having a problem.